ADJUSTABLE BICYCLE SEAT POST ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates generally to adjustable bicycle seat posts, and more particularly to a sliding seat post within a post that allows a bicycle seat to be adjusted while a bicycle is being ridden.

2. Description of the Related Art

[0002] For those engaged in competitive cycling, such as the sport of mountain biking, it is sometimes advantageous to adjust the position of the body while riding in order to optimize the control and power over the bike. For instance, when descending a steep hill, a rider sometimes will drop back behind the bicycle seat in order to lower the body position and thereby gain more control over the bike. At most other times, such as on flat terrain, it is most advantageous for the rider to be seated on the bicycle seat in order to achieve optimum pedal power.

[0003] Another challenge faced by competitive mountain bikers is that the various components of the bike are subjected to exposure to water, mud, dirt and other debris which can quickly impair the proper operation of various moving parts.

[0004] Various adjustable-height bicycle posts have been proposed which enable a user to vary the height of the seat between two or more positions while riding. The posts are typically in the form of a telescoping tube structure that is mounted at it lower end one end in the receptacle of a bicycle frame in place of a conventional one-piece fixed length bicycle post, and which carries a seat at its opposite upper end. Some form of a locking mechanism is provided which selectively

locks the tubes in one of two or more positions. In some cases, a spring is provided which acts to constantly bias the tubes toward an extended condition.

[0005] None of the adjustable seat post configurations presently known to the inventors is believed to be satisfactory to withstand the rigors of competitive mountain biking. It is believed that the latching mechanisms are too weak to withstand the constant pounding they would encounter while supporting the weight of the rider over rough terrain. Moreover, some of the locking mechanisms are external and others, while at least in part internal, are insufficiently protected against the intrusion of dirt, mud, water and other debris that would be certain to disable the operation of the locking mechanisms in short order. There is further the general inability to readily disassemble the locking mechanism and other moving components in order to clean the dirt and debris out of the assembly to restore proper operation in the event the assembly is fouled.

[0006] It is an object of the present invention to overcome or greatly minimize the forgoing disadvantages of prior adjustable bicycle seat post assemblies.

SUMMARY OF THE INVENTION AND ADVANTAGES

[0007] The invention provides an adjustable bicycle seat post assembly comprising an inner tube telescopically supported within an outer tube. A lower end of the outer tube is dimensioned to be received in a receptacle of a bicycle frame in order to mount the outer tube firmly to the bicycle frame. The inner tube is slidable relative to the outer tube in order to adjust the effective length of the telescopic tubes. The outer tube houses a spring which acts between the outer and inner tubes and constantly biases the inner tube toward an extended condition. A locking mechanism is fixed to the outer tube and includes a locking pin which extends through an opening

in the outer tube. The inner tube has at least two longitudinally spaced openings that are selectively alignable with the opening of the outer tube during movement of the inner tube relative to the outer tube. When so aligned, the locking pin is extendable into the opening of the inner tube in order to lock the inner tube against longitudinal movement relative to the outer tube against the force of the spring. The portion of the pin extending into the inner tube opening is fully supported to its inner distal end by the wall of the inner tube opening. The portion of the pin extending through the outer tube opening is likewise fully supported and is further supported by a wall of a housing of the locking mechanism projecting radially outwardly of the outer tube.

[0008] Such full support of the locking pin by the inner and outer tubes as well as the reinforced housing provides robust support to the tubes sufficient to withstand the constant pounding and shear force that the pin is subjected to during competitive use. The hollow tubular structure reduces the weight of the structure.

[0009] According to another aspect of the invention, the locking mechanism is able to be readily disassembled to allow for cleaning of the mechanism in the event dirt and other debris enter the mechanism.

[00010] According to a further aspect of the invention, an adjustable height tube-in-a-tube bicycle post assembly is provided having a spring which constantly acts to extend the tubes and a magnetic locking mechanism. The locking mechanism has a set of magnets which act to selectively move a locking pin and thereby extend or retract the pin. When retracted, the inner tube is freely slidable relative to the outer tube. When extended, the pin is positionable into alignable openings of the inner and outer tubes to thereby lock the tubes against relative movement. The magnetic

locking mechanism provided a very simple, reliable, robust means of quickly and efficiently locking and unlocking the tubes on the fly.

[00011] According to a further aspect, the invention contemplates that the magnetic locking mechanism can be used in conjunction with other than adjustable bicycle seat posts. The magnetic locking mechanism per se comprises a housing supporting a slidable locking pin and housing a set of oppositely polarized magnets. The magnets are supported by a slide shoe which is slidable relative to the housing and which selectively moves one or the other of the magnets into position to either repel or attract the locking pin, causing the pin to slidably extend or retract relative to the housing. Such a magnetic locking mechanism is simply constructed, is comprised of few parts, and is very effective in operating the movement of the pin.

THE DRAWINGS

[00012] These and other features and advantages of the present invention will become more readily appreciated when considered in connection with the following detailed description and appended drawings, wherein:

[00013] Figure 1 is a schematic view of a bicycle having the adjustable seat post mounted thereon;

[00014] Figure 2 is an exploded view of a first embodiment of the adjustable seat post assembly;

[00015] Figure 3 is an enlarged cross-sectional view of the assembly shown in the lowered position;

[00016] Figure 4 is a view like Figure 3, but shown in the raised position;

[00017] Figure 5 is a view like Figures 3 and 4, but shown in an intermediate position;

[00018] Figure 6 is a perspective view of the locking mechanism housing;

[00019] Figure 7 is an enlarged fragmentary perspective view of the magnetic latch mechanism;

[00020] Figure 8 is an exploded perspective view of an assembly according to a second embodiment of the invention;

[00021] Figure 9 is a perspective view of the assembly of Figure 8 shown in a lowered position;

[00022] Figure 10 is a view like Figure 9, but shown in the raised poisiton;

[00023] Figure 11 is a sectional view taken generally along lines 11-11 of Figure 9;

[00024] Figure 12 is an enlarged cross-sectional view of the assembly of Figure 9;

[00025] Figure 13 is a view like Figure 12, but shown in the raised position;

[00026] Figure 14 is a side view of the latch housing;

[00027] Figure 15 is a plan view of the latch housing; and

[00028] Figure 16 is a partially exploded perspective view of the manual latch mechanism.

DETAILED DESCRPTION

[00029] Referring to the Figures, wherein like numerals indicate like parts throughout the several views, an adjustable bicycle seat assembly is shown generally at **20**.

[00030] Referring now to Figure 1, the seat post assembly **20** comprises a hollow inner seat post or tube **22** that slides inside a hollow outer tube **24** along a longitudinal axis **26**, and a locking mechanism **28** interconnecting the post **22** in

various adjustable positions relative to the tube **24**. The locking mechanism **28** may be manipulated through various means to engage or release the post **22**, as described in more detail below. There are two alternative representative embodiments of locking assemblies according to the invention, one remote actuated magnetic switch assembly **29** as shown in Figures 1-7 and the other a manual release assembly **30** as shown in Figures 8-16. Their respective constructions and operations will be described below.

[00031] Preferably, the outer tube **24** is fabricated of a lightweight corrosion-resistant metal having thin walls, and the post **22** is composed of a lightweight metal having thicker walls than that of the outer tube **24**. The preferred material for the inner and outer tubes 22, 24 is aluminum or an aluminum alloy, although the invention is not to be limited by these materials.

[00032] Referring now additionally to Figures 2-5, the outer tube **24** is configured at its lower end to be slidably received in a conventional seat post receptacle in the frame **31** of a bicycle **34** in the usual manner of a conventional, single-tube bicycle seat post **22**. The opposite upper end of the inner tube **22** is fitted with a bracket **36** suitable for mounting a bicycle seat or saddle **40** to support the weight of a rider.

[00033] As best shown in Figures 2 and 11, a pair of shims **42**, preferably fabricated of plastic, are removably inserted into notches **44** on the inner post **22** to glide in vertical grooves **46** located inside the outer tube **24** along the longitudinal axis **26**. The shims **42** allow the post **22** to move up or down relative to the outer tube **24**, but support the inner post **22** post against rotational movement relative to the outer

tube **24**. After a period of use and wear, the plastic shims **42** may be inexpensively replaced to prolong the life-span of the bicycle seat assembly **20**.

[00034] A top ring cap **50** is carried about an extended portion of the inner post **22** that extends above the outer tube **24** and is threadable onto the outside of the upper end of the outer tube **24** to provide a serviceable connection between the tubes **22,24** that prevents them from separating from one another during normal use, but yet enables a user to dissemble the tubes in order to clean the interior or replace worn or broken components as the need arises. The ring cap **50** forms a water and debris-tight seal with the outer tube **24** and further has a hole **52** through which the post **22** extends presenting an annular wiping lip that rides against the inner post **22** and which preferably provides a water and debris-resistant ring seal about the relatively slidable inner post **22** to discourage the entry into the inner tube **24**. Preferably, the top ring cap **50** is fabricated of a lightweight plastics material, such as nylon or the like. An O-ring seal **56** is also preferably disposed about the post **22** below the top cap **50** to enhance the sealing characteristics of the top ring cap **50**.

[00035] A seat clamp collar **58** integral with the post **22** is located at the bottom of the seat clamp mount **36** and defines a collar diameter greater than the diameter of the top cap central hole **52**. The collar **36** defines a stop surface or shoulder for the inner post **22** which confronts the top ring cap **50** when the inner post is in a fully distended or retracted position. The top ring cap **50** thus serves to not only couple the inner and outer tubes **22,24** but to limit their travel to define fully extended and retracted positions of the tubes **22,24**. Additionally, a bushing or sleeve **62**, which is preferably fabricated of a plastics material such as nylon or the like, is disposed about the post **22** between the shims **42** and top cap **50**. A body of the sleeve **62** extends

into the outer tube **24** through its open top and serves as a bearing to take up the annular operating clearance between the inner and outer tubes **22, 24**. A top flange **64** of the sleeve **62** is captured between the top ring cap **50** and the top end of the outer tube **24** to support the sleeve **62** in position. When in the fully extended position, the shims **42** of the inner post **22** preferably contact the body of the sleeve **62** to effectively limit the outward travel of the inner post **22** relative to the outer tube **24**. The sleeve **62** is readily removable from the outer tube **24** during disassembly to accommodate cleaning and/or servicing of the assembly as needed.

[00036] The bottom end of the outer tube **24** is open and is closed by a removable end cap **70**. Preferably, the lower end of the outer tube **24** is internally threaded and the end cap **70** is externally threaded. The end cap **70** is threaded into the outer tube **24** to close the lower end, but yet the end cap **70** remains separable to allow access to the bottom of the post **22**. The bottom cap nut **70** is preferably fabricated of a lightweight metal compatible with that of the outer tube material to minimize corrosion, such as aluminum or aluminum alloys, and includes a hex shaped tool-receiving recess **72** for receiving a wrench for tightening and loosening the end cap **70**. The end cap **70** supports the lower end of a main compression spring **76** housed within the outer tube **24**. The upper end of the spring **76** abuts a shoulder or collar **74** provided on the inner post **22** adjacent its lower end. The spring **76** acts in compression between the end cap **70** and the shoulder **74** to exert a recoil spring force that constantly urges the inner post **22** longitudinally outwardly of the outer tube **24** toward the fully extended position. The main spring **76** force (spring rate) can be adjusted by threading the bottom cap nut **70** toward or away from the shoulder **74**.

[00037] Referring now to Figures 6 and 7, the locking mechanism **28** includes a foundation or housing **80** disposed on the outside of the tube **24** and a projection portion **82** integral with the foundation **80** extending radially from the longitudinal axis **26** to a distal end **84**. A counterbore **86** defined in the projection **82** extends perpendicularly to the longitudinal axis **26** and slidably supports a locking pin or plunger **88**.

[00038] The foundation **80** includes a concave part-cylindrical bottom surface **90** corresponding in size and shape to the outer surface **92** of the outer tube **24**. The bottom surface **90** extends less than **180** degrees about the circumference **92** of the tube **24**, allowing the bottom surface **90** to be pressed against the outer tube **24** and adhesively secured. The foundation **80** also includes an outer surface **94** opposite to the bottom surface **90**. This outer surface **94** includes at least one flat outer surface **96** extending tangentially to the circular bottom surface **90**. A cross section of this outer surface **94** preferably defines a polygon segment of flat surfaces, such as one half of an octagon as shown in Figure 6. Preferably, the projection **82** extends laterally from a centrally located flat surface **96** on the foundation **80**.

[00039] A plurality of holes **102** located on the post **22** have a force-bearing diameter **104** for receiving the plunger **88** and holding the post **22** in a fixed position relative to the hollow tube **24**. The plunger **88** has a force-bearing section **106** that is slidably supported by a force-bearing length **108** of counterbore **86** within the projection **82** and foundation **80**. This force-bearing section **106** of plunger **88** is fully supported along the entire force-bearing length **108** of counterbore **86** when the plunger **88** engages the holes **102** in the post **22**. In addition to the force-bearing section **106**, the plunger **88** includes a disk **110** extending radially from the plunger

88. The disk 110 has a disk diameter 112 greater than the force-bearing diameter 104 and is slidably supported inside the counterbore 86 by a disk-bearing length 114 of counterbore 86.

[00040] The projection 82 defines a height 116 along the longitudinal axis 26, and a width 118 perpendicular to the height 116. Preferably, the height 116 is greater than the width 118. The projection 82 also defines a wall thickness 120 surrounding the counterbore 86. Preferably the wall thickness 120 is greater in the direction of the height 116 than in the direction of the width 118, making the projection 82 strongest along the longitudinal axis 26 to bear the shearing forces on the plunger 88 while keeping the projection 82 dimensions small.

[00041] In the remote controlled magnetic switch assembly 29 shown in Figures 1-7, the plunger 88 is preferably manipulated via a push-pull cable 122 connected to a remote thumbswitch 124. The push-pull cable 122 is of the type commonly used in bicycles, with an outer sheath 126 that movably supports an inner control cable 128. A housing 130 is integral with the distal end 84 of the projection 82 and covered by a main unit endcap 132. The endcap 132 is secured to the housing 130 by two cap screws 134 that extend through endcap holes 136 in the endcap 132 and thread into cap screw holes 138 in the projection 82.

[00042] A slider bar or slider shoe 140 is disposed in the housing 130, below the endcap 132 and above the plunger 88, for sliding movement inside the housing 130 along a slider axis 142 between a first position 144 and a second position 126. The disk 110 section of the plunger 88 includes a plunger magnet 148 having a plunger magnetic polarity facing the slider bar 140. The slider bar 140 includes an attracting magnet 150 having an attracting magnetic polarity opposite to the plunger

magnetic polarity. The attracting magnet **150** is embedded in the slider bar **140** to be centered over the plunger magnet **148** when the slider bar **140** is in the first position **144**, thereby disengaging the plunger **88** from the post **22** when the slider bar **140** is in the first position **144**. Preferably, the first position **144** is defined when the slider bar's motion along the slider axis **142** is checked by contact with the housing **130**. The slider bar **140** also includes a repelling magnet **152** having a repelling magnetic polarity matching the plunger magnetic polarity. The repelling magnet **152** is embedded in the slider bar **140** to be centered over the plunger magnet **148** when the slider bar **140** is in the second position **126**, thereby engaging the plunger **88** with the post **22** when the slider bar **140** is in the second position **126**. Preferably, the second position **126** is defined when the slider bar's motion along the slider axis **142** is checked by contact with the housing **130** at the end of the slider axis **142** opposite to the first position **144**.

[00043] The housing **130** includes a pair of threaded screw holes **154** in the direction of the slider axis **142** and tension set screws **156** threaded into these screw holes **154**. A pair of slider bar springs **158** fit into a pair of spring holes **160** disposed on the slider bar **140** and mesh with the tension set screws **156** in the housing **130**. The slider bar springs **158** force the slider bar **140** into the second position **126**. Additionally, the housing **130** and slider bar **140** have a rounded shape **162** opposite to the slider bar springs **158** to ensure that the slider bar **140** rests snugly when forced into the second position **126** by the slider bar springs **158**.

[00044] A cable mount **164** disposed outside the housing **130** holds the cable's **122** outer sheath **126** against the housing **130** in a fixed position. The cable mount **164** is located on the same side of the housing **130** as the tension set screws **156** along

the slider axis **142**, and the cable **122** extends parallel to the longitudinal axis **26** near the cable mount **164**. The inner control cable **128** extends through a cable hole **166** in the housing **130** and connects to the slider bar **140** for moving the slider bar **140** in proportion to the pressure applied to the thumbswitch **124**. In this first embodiment, the thumbswitch **124** counteracts the force of the tension set screws **156** to move the slider bar **140** into the first position **144** and disengage the plunger **88** from the post **22**. When the thumbswitch **124** is released, the slider bar **140** moves to the second position **126** and engages the plunger **88** with the post **22**.

[00045] In the manual release assembly **30**, the plunger **88** is manually manipulated. Referring to Figures 8-16, a knob supporting section **168** of plunger **88** extends from the disk **110** and has a diameter less than the disk **110**, so that the disk **110** is located between the force-bearing section **106** and the knob supporting section **168**. An endcap **132** is secured to projection **82** by two cap screws **134** that extend through endcap holes **136** in the endcap **132** and thread into cap screw holes **138** in the projection **82**. The knob supporting section **168** of the plunger **88** extends through a knob hole **169** in the top cap **50**, and a knob **170** is attached to the distal end **84** of the plunger **88** extending outside of the projection **82**. A spring **174** disposed about the plunger **88** reacts between the disk **110** and the endcap **132**, causing the plunger **88** to engage the post **22** until the knob **170** is pulled away from the tube **24** by manual manipulation.

[00046] In both embodiments, a bicycle seat **40** is mounted to the seat post assembly **20** using a seat clamp assembly **176** that attaches to the seat clamp mount **36**. The seat post **22** is mounted to a bicycle **34** by attaching the tube **24** to the bicycle **34** in the same manner as an ordinary seat post **22**. During this seat mounting process,

the seat height **116** relative to the bicycle **34** is adjusted to be in a high position for optimal power, with the post **22** fully extended. After the seat is mounted, manipulation of the plunger **88** to extend or distend the post **22** allows the seat to transition between a high position and a low position while the bicycle **34** is being ridden. During competitive mountain biking, for example, a rider can quickly lower the seat by operating the lever to unlatch the locking pin 88 from the inner post 22 while maintaining sufficient body weight on the seat to overcome the constant upward force of the main spring 76. Once the inner post 22 begins to move downwardly, the rider can release the lever and the pin will drop into the upper-most hole of the inner post 22 to lock the inner post 22 in the lowered position. To return the seat to the fully raised condition, the lever is again actuated to unlatch the pin 88 while the user lifts his body to decrease the counterweight on the seat by an amount sufficient to enable the main spring 76 to raise and return the inner post 22 to the fully raised position.

[00047] The invention further contemplates that the magnetic switch per se can be used apart from the seat post application in any of a number of other applications calling for a locking mechanism.

[00048] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practiced otherwise than as specifically described within the scope of the claims. In addition, the reference numerals in the claims are merely for convenience and are not to be read in any way as limiting.